



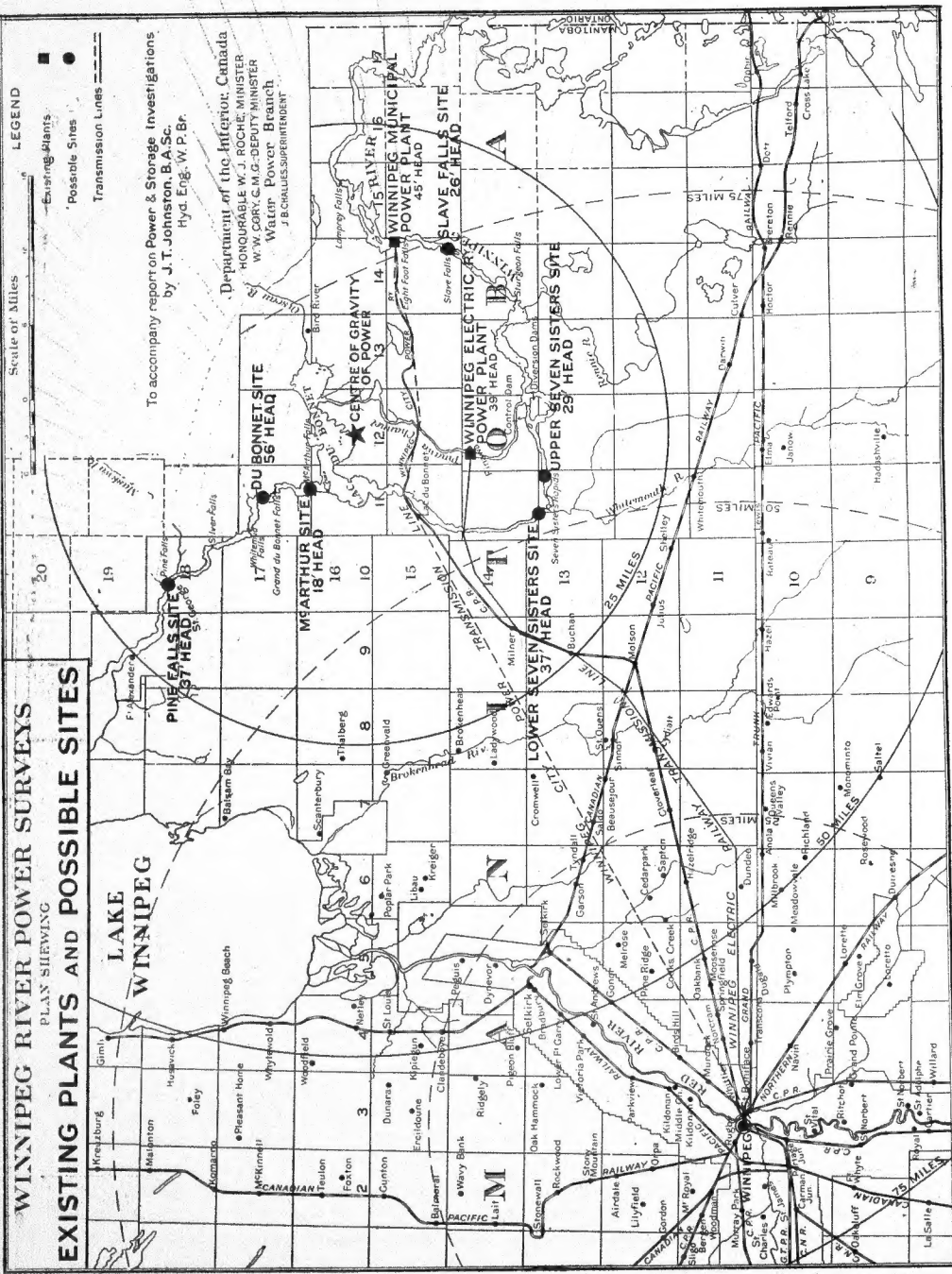
**Measureless energy  
From Ceaseless Streams**  
320,000 continuous horsepower  
now under development.

**The Dynamic Force Behind  
Winnipeg**

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To accompany report on Power & Storage Investigations.  
by J. T. Johnston, B.A.Sc.  
Hyd. Eng. W. P. Br.

Department of the Interior, Canada  
HONOURABLE W. J. ROCHE, MINISTER  
W. W. CORY, C.M.G., DEPUTY MINISTER  
Water Power Branch  
J. B. CHAPLAIN, SUPERINTENDENT



# POWER

## *The Dynamic Force Behind Winnipeg's Growth*

*Engineers Rapidly Harnessing Giant  
Water Powers on Winnipeg River*



THE City of Winnipeg is with justice termed "The Gateway of the Great West," for it stands on the threshold of the vast and fertile plains of mid-Western Canada. The great expanse of forest, lake and stream to the East does not lend itself to the support of a large population, consequently, with the exception of Port Arthur and Fort William, which owe their growth to their position as ports at the head of the Great Lakes, Winnipeg is the first city of any magnitude for upwards of 1,000 miles on the journey West from Toronto and Montreal. This fact alone has made Winnipeg the logical distributing point whence products from the East begin to scatter to their ultimate destinations in Manitoba, Saskatchewan and Alberta, and to which the agricultural products of the prairies converge en route to the Eastern market.

Thus Winnipeg was ensured of a certain growth as a distributing centre in virtue of its geographical position alone, and railway lines have sought it not only from East and West but from the South, where, not far distant, lie the great middle Western industrial centres of the United States.

Had geographical position nothing else to offer, Winnipeg must have remained a city of moderate size, able to support only those engaged in transportation, distribution and the smaller manufacturing industries, the long distance from sources of coal supply would have made it impossible to compete with Eastern Canada and the United States as a large scale manufacturing centre.

Fortunately, however, the "Gateway" showed opportunities in both directions and nature provided the one thing lacking, namely power, in lavish quantities. A short distance to the northeast, the Winnipeg River, collecting the waters from 55,000 square miles of lake and forest, flows over a series of magnificent waterfalls on its journey to Lake Winnipeg, and not only supplies all the city's needs for motive power, but can supply them for years to come.

The vast power possibilities of the Winnipeg River were early recognized by the Federal authorities, and in the early summer of 1911 a systematic and comprehensive investigation of the entire power reach was commenced by the Dominion Water Power Branch of the Department of the Interior. These investigations included the establishment of gauging stations for obtaining reliable data concerning the amount of water available; these have since been maintained and added to; systematic surveys of the banks of the river with cross-sections and soundings wherever necessary and finally a very thorough study of the information secured with a view to designing a system of development

that would secure the maximum advantageous use of the power resources of the river.

The results of the investigation have been published as Water Resources Paper No. 3, which deals exhaustively with the whole question and makes available to the public reliable information as to the various sites, the power available at each and the approximate cost of developing the same. This paper establishes the outstanding fact that there is approximately half a million horse power available on the Winnipeg River within easy transmission distance of Winnipeg, and that the undeveloped portion of this power can be concentrated at seven sites, each of which lends itself to development on a basis that is thoroughly sound both from the engineering and the economic standpoints.

Since the report was published in 1915 certain revisions in power estimates have become possible through the receipt of later stream flow data; these revisions have been adopted in the following brief account of the various power sites.

### **How Great Power Sites Are Developed**

The Winnipeg River in Manitoba is greatly enlarged just before entering the province by receiving the waters of the English River, of almost the same size as the Winnipeg before the junction.

The Upper Winnipeg issues from the Lake of the Woods, the level of which can be regulated by the Norman Dam and which forms, therefore, a controlled storage basin 1,500 miles in extent. This lake receives the flow of Rainy River, in its turn controlled by dams at the outlet of Rainy Lake, 350 square miles in area and, Lake Namakan, of 100 square miles.

Thus the Upper Winnipeg, well controlled naturally by the numerous lakes and muskegs in its 26,750 square miles of drainage basin, has the additional benefit of artificial regulation of nearly 2,000 square miles of reservoirs.

The English River issues from Lac Seul, 340 square miles in area, and is itself virtually a chain of large lakes for 150 miles to its junction with the Upper Winnipeg. Its flow is therefore remarkably well regulated naturally and there are opportunities, not yet availed of, for further regulation by artificial means.

Thus we see that the Winnipeg River in Manitoba drains in the neighborhood of 55,000 square miles of territory and that its flow is well regulated. This flow reaches a minimum of 11,000 second feet. The maximum observed since regular measurements have been taken is 69,400 c.f.s., though high water marks along the river indicate that a maximum of 100,000 has been attained in the past. Careful investigations indicate that, when the river is completely regulated, a dependable flow of 20,000 second feet can be ensured, while the ordinary minimum flow is 15,500 under present conditions. This means that every foot fall in the river represents at 75 per cent. efficiency 1,400 continuous horse-power under present conditions, and over 1,800 under complete regulation.

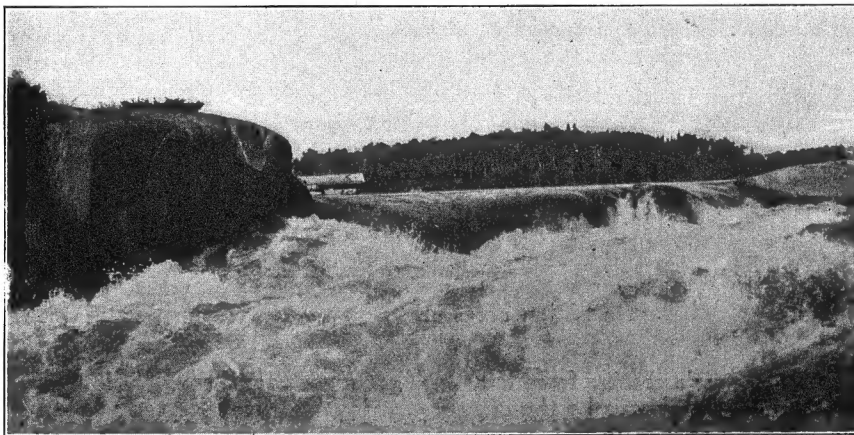
About 20 miles downstream from the boundary of the province Point du Bois Falls is reached, the site of the City of Winnipeg Municipal Hydro-Electric Station, which has a turbine installation of 47,000 horse-power and operates under an average head of 45 feet. The generator

installation is 30,000 k.w. and the power house has been constructed with provisions for future extensions up to 100,000 horse-power. The peak load now carried exceeds 20,000 k.w., the pondage 7 square miles in extent immediately above the plant greatly increases the ability of the plant to carry peak loads. The power is transmitted 75 miles to Winnipeg over a double three-phase line supported upon steel towers.

Four miles below the municipal plant is Slave Falls, where 26 feet is available, equivalent to 36,480 continuous horse-power at ordinary minimum flow and 47,270 with complete regulation. The natural conditions render this a very attractive site for development, both from engineering and economic considerations.

### **The Power Sites of the Seven Sisters**

The next point of interest is where the river divides into two channels, the right or Pinawa carrying 8,000 c.f.s. into the east end of Lac du Bonnet. On this channel is situated the hydro-electric station of the Winnipeg Electric Railway, which, operating under an average



**WINNIPEG RIVER—SEVEN SISTERS, SECOND FALL**

head of 40 feet, has an installed turbine capacity of 35,600 horse-power and 14,000 k.w. generator equipment. This power is transmitted 58 miles to Winnipeg and district for power, lighting and street railway purposes.

Three miles above this plant is what is known as the Upper Pinawa site, where a head of 18 feet could be secured and 13,100 horse power developed at a cost that would render it attractive as an auxiliary to the present Winnipeg Electric Railway Company development.

The left channel of the Winnipeg River also enters Lac du Bonnet, and on this reach there are two sites. The Upper Seven Sisters, where 29 feet head is available, could, after allowing for the flow down the Pinawa channel, develop 19,560 continuous horse-power at ordinary minimum and 31,635 horse-power with regulated flow.

The Lower Seven Sisters would provide a 37-foot head, yielding 25,000 horse-power and 40,400 horse-power respectively. Neither of these two sites will be particularly attractive economically until the river is fully regulated.

## *The Secrets of Winnipeg's Remarkable Growth as an Industrial Centre*

¶ Winnipeg dominates the greatest growing market in the world, and controls a greater trade area than any other city on the American continent.

¶ Winnipeg's jobbing conditions are ideal. Goods may be quickly and cheaply moved to any part of the West from Winnipeg. The market is at her doors.

¶ Winnipeg has available and easily accessible abundant varieties of raw materials for manufacturing purposes: grain, wool, flax-seed, sugar beet, barley, clay, straw, pulp, lime-stone and sand, iron and mineral deposits, gypsum, peat, salt, manganese, etc.

¶ The agricultural development and consequent expansion of railroads in Western Canada is so great that new towns spring up every year. The needs of these towns and new farming communities all tend to swell Winnipeg's market for manufactured goods.

¶ Winnipeg is nearer the great growing Western market by hundreds of miles than the Eastern manufacturing cities. This saves long freight hauls and cuts cost of distribution.

¶ The fortunate power situation on the Winnipeg River cannot be duplicated anywhere on the North American continent. Winnipeg has, and always will have, the most attractive power rates in America.

¶ Winnipeg is the open door to a rich and growing market, with an area of almost half a billion acres and a population of a million and a half people.

¶ All railroads passing from East to West must pass through Winnipeg. This city will always be the central distributing point for the whole of Western Canada. Seventeen thousand miles of railways cover the Western field.

¶ Winnipeg is expanding financially and commercially more rapidly than any modern city of like size. It is just on the eve of the greatest period of development it has yet known.

¶ A \$16,000,000 aqueduct now supplies Winnipeg with pure soft water from Shoal Lake, Ontario, 100 miles distant. Daily capacity, 100,000,000 gallons. Supply inexhaustible and of excellent quality.

¶ Winnipeg's citizens are fully alive to the importance of patronizing home industries. They co-operate in this and in all other movements for the public good with loyalty and enthusiasm.

¶ In Winnipeg technical education is available for all industrial workers who wish to increase their efficiency. Night classes held in a number of splendid and up-to-date technical schools are largely attended.

## *Facts That Tell Vivid Story of Winnipeg's Wonderful Power Resources*

¶ The Winnipeg River alone has sufficient power to supply the needs of a population in Winnipeg of 2,500,000 persons.

¶ Manitoba has available power to supply three cities the size of New York and Chicago combined.

¶ If Winnipeg's power was all developed, it would provide employment for from 150,000 to 300,000 workers.

¶ Winnipeg has sufficient available power to turn out a product worth in the neighborhood of a billion dollars every year.

¶ The newest addition to Winnipeg's power plants will have an ultimate supply of 168,000 continuous 24-hour h.p. It will cost, when completed, more than \$9,000,000.

¶ One of Winnipeg's hydro-electric power plants is the largest in the world.

¶ Winnipeg has enough power available to drive the wheels of all the industrial machinery now operating in Canada.

¶ From the time Winnipeg's power was turned on in 1911, there has been but one interruption in service.

¶ The City of Winnipeg's power site covers 438 acres. The present building is 250 feet long and 150 feet wide and 100 feet high. Extensions can be made to provide for 100,000 h.p.

¶ Winnipeg's power transmission line is 77 miles in length. Telephone line runs along the entire distance with booths at intervals.

¶ A special rate of 1 cent per k.w.h. is provided in Winnipeg for heating and cooking purposes. Power is furnished for manufacturing purposes from ½ cent per k.w.h. up. Residence lighting at 3 1-3 cents per k.w.h.

¶ How cost of electric lighting in Winnipeg has been reduced:—

1906	-	-	20 cents per k.w.h.
1907	-	-	10 cents per k.w.h.
1911	-	-	7½ cents per k.w.h.
1912	-	-	3 1/3 cents per k.w.h.

### *A Story of Progress*

¶ How manufacturing increased in Winnipeg in fifteen years:—

Capital invested increased	-	1480%
Value of product increased	-	1770%
Persons employed increased	-	637%
Increase in population	-	446%
Reduction in price of power	-	76% (12½ cents to 3 1-3 cents)

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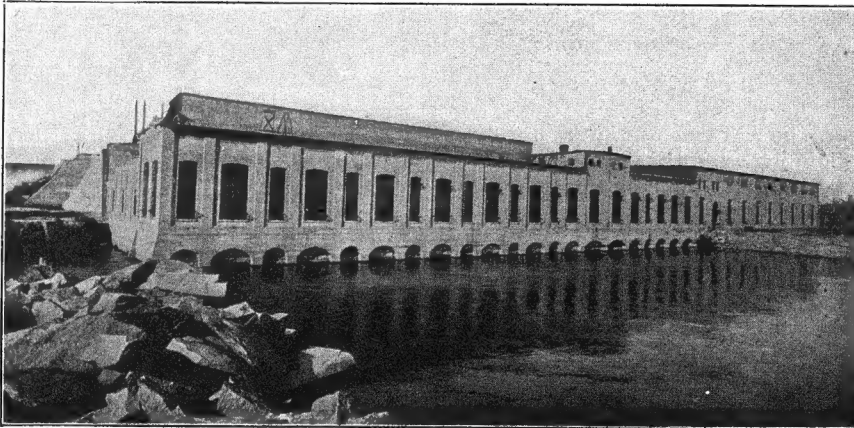
# WINNIPEG DOMINATES WESTERN CANADA

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At the outlet of Lac du Bonnet are two falls about  $1\frac{1}{2}$  miles apart; these can be combined at the lower fall, and at this site, known as the McArthur site, 18 feet would be available, which, under ordinary minimum flow conditions, will yield 25,250 continuous horse-power and 32,700 horse-power with regulated flow. Lac du Bonnet will form a pond for this plant 38 square miles in area and of immense value in carrying peak loads.

Four miles or so downstream we come to a series of falls known as the Du Bonnet Falls, which can be combined with the drop at White Mud Falls at what is known as the Du Bonnet site, 64 miles in a direct line from Winnipeg. The head available here is 58 feet, giving 81,300 continuous horse-power at ordinary minimum flow, and 105,400 horse-power with fully-regulated flow; this is probably the best site, economically, on the whole river.

The last site on the river, near where it enters Lake Winnipeg, is known as the Pine Falls site, where the fall in Silver and Pine Falls can be combined and a head of 37 feet secured, this under ordinary minimum



WINNIPEG RIVER—PINAWA CHANNEL  
STREET RAILWAY COMPANY'S POWER HOUSE, SHOWING TAILRACE

flow would yield 51,900 continuous horse-power and 67,200 horse-power under regulated conditions at a cost per horse-power very little greater than for the last-mentioned site.

The Pine Falls site possesses certain attributes which offer splendid opportunities for its use as a pulp and paper manufacturing site. The entire river basin above is available as a source for pulpwood supplies. Widening of this source to include pulpwood areas adjacent to Lake Winnipeg assures access to vast pulpwood areas. Undoubtedly the site has great possibilities as a centre of development for the pulp industry.

Water will be drawn at the Pine Falls site from a deep, quiet pond direct into the turbine with a minimum disturbance, and will be entirely free from ice troubles. The power station has been designed for turbines of 10,000 horse-power capacity.

This is but a brief survey of the actual and potential power developments of the Winnipeg River, and is for convenience tabulated below.

### Developed Power

SITE	Licensee	Turbine h. p. installed
*Point du Bois	City of Winnipeg.	47,000
Pinawa Channel	Winnipeg Electric Railway Company.	35,600
	Total	82,600

\*Not fully developed; ultimate installation 100,000 h.p.

### Undeveloped Power

SITE	H.P. at 80% efficiency		Distance from Winnipeg
	Ordinary minimum flow	Dependable with storage	
*Point du Bois .....	16,000	35,000	75
Slave Falls .....	36,480	47,270	74
Upper Pinawa .....	13,100	13,100	58
Upper Seven Sisters...	19,560	31,635	55
Lower Seven Sisters..	25,000	40,400	52
McArthur Falls ....	25,250	32,700	64
Du Bonnet .....	81,300	105,400	64
Pine Falls ..	51,900	67,200	64
Total ....	268,590	372,705	

\*Portion not yet developed.

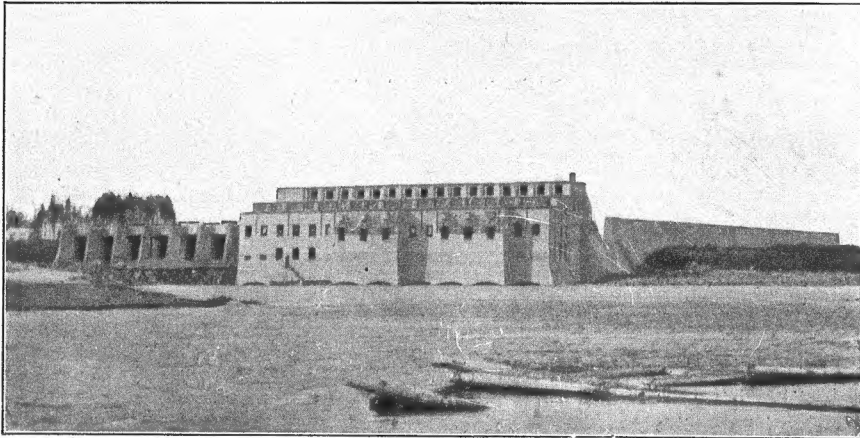
It is exceedingly fortunate that none of the undeveloped power sites have been alienated, and that all are held by the Crown for development in the best public interest. The Dominion Water Power Branch of the Department of the Interior is charged with the administration.

To give an adequate account of the policy of the Department would unduly extend this brief article. It will suffice to say, however, that it demands that the power plants shall be designed and constructed in such a way as to be both stable and of pleasing appearance. It demands that the interests developing power shall be financially reliable, and shall submit evidence that the power developed will find a suitable market, and that where the power is used for public uses the rates

charged shall be subject to control. Finally, the rentals charged the licensee, no site being sold outright, are fixed with the idea of aiding the development over its early years, and later, consistent with cheap rates to the consumers, securing a reasonable payment to the public treasury for the use of a public natural resource.

### Half-Million Horse-Power at Winnipeg's Doors

Probably the immense importance to Winnipeg and district of the Winnipeg River power can best be realized by a brief recital of the various interests affected. The total peak load of Greater Winnipeg on the City and the Street Railway Company's power stations was 64,300 horse-power in 1914. The population was 276,177, there were 418 factories actually using this power having \$53,000,000 capital invested, 18,500 employees drawing \$11,250,000 wages and turning out a product valued at \$45,000,000 per year.



WINNIPEG RIVER—POINT DU BOIS  
CITY OF WINNIPEG MUNICIPAL DEVELOPMENT

In 1915 we find that the interests of all kind owning or using Winnipeg River power in Greater Winnipeg or Selkirk, but excluding institutions and domestic supply, had \$169,680,000 capital invested, employed 30,828 persons with an annual pay-roll of \$24,110,000 and turned out a product valued at \$135,600,000.

We see that in 1914 the total **peak** load was only 64,300 horse-power while there is still undeveloped a total of 268,600 continuous horse-power at ordinary minimum and 272,700 horse-power with regulated flow, while there would be a **peak** capacity considerably exceeding these figures. It is, therefore, no exaggeration to say that there is sufficient power still available on the Winnipeg River to supply the needs of a population and industries more than five times and possibly eight or ten times as great as was supplied in 1914 and 1915. In other words there is sufficient power to supply the needs of a population of from 1,500,000 to 2,500,000 persons, to provide direct employment for from 150,000 to 300,000 workers, and to turn out a product worth in the neighborhood of one billion dollars every year.

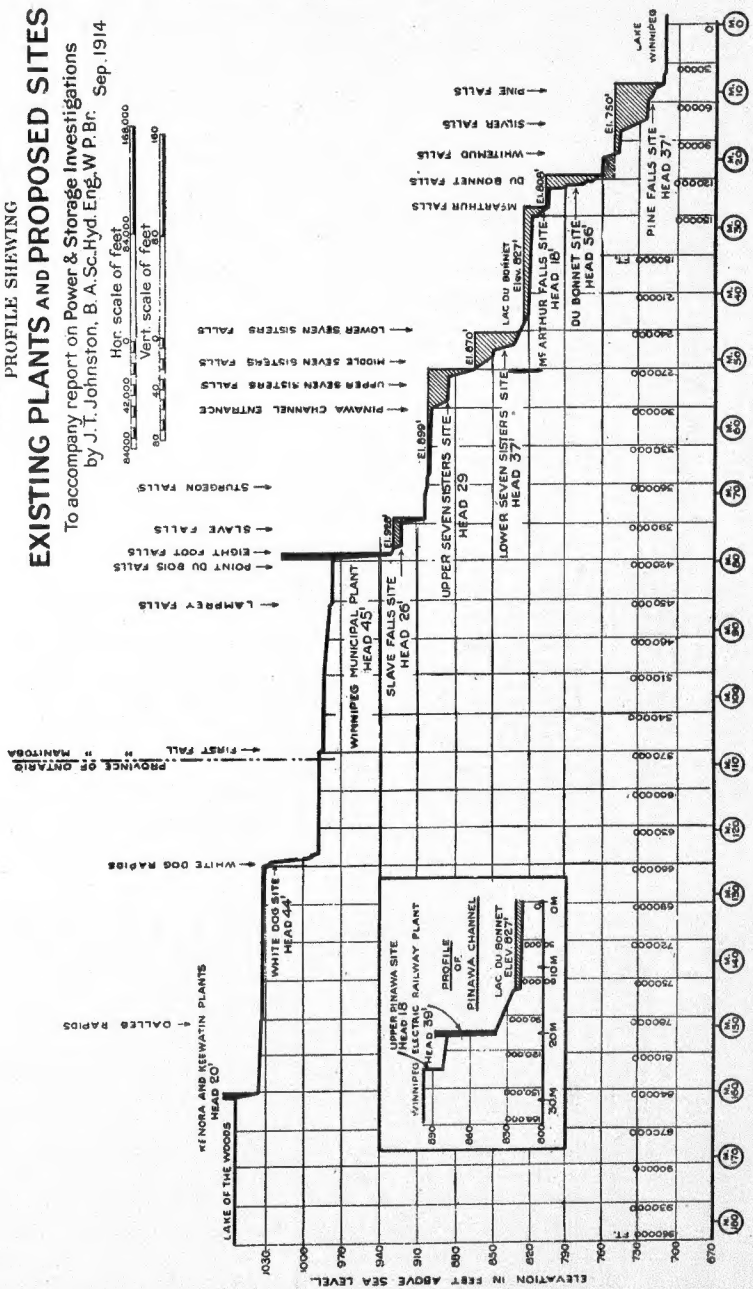
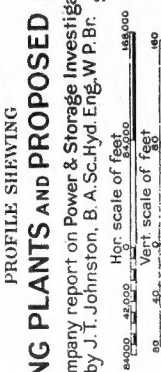
Water Power Branch  
J.B. CHALLIES, SUPERINTENDENT

# WINNIPEG RIVER

## PROFILE SHEWING

### EXISTING PLANTS AND PROPOSED SITES

To accompany report on Power & Storage Investigations  
by J.T. Johnston, B.A.Sc., Hyd. Eng., W.P.Br. Sep. 1914



# WONDERFUL WINNIPEG

## Facts About the "Chicago of Canada"

Population, 1870.....	215
Population, 1919.....	262,000
1870.....	A fur-trading post
1919.....	Area, 15,287 acres

The first railway reached Winnipeg from the South in 1878. Today, Winnipeg is Canada's greatest transportation centre, with 27 railway lines reaching every part of the country. All railroads passing from the East to the West must pass through Winnipeg. There are 17,000 miles of railways in Winnipeg's business field.

Winnipeg's first bank was established in 1892. Bank clearings for 1919 were over two billion. Winnipeg entered the billion dollar class as a banking centre in 1911, and today ranks among the leading banking centres of the continent. Her yearly clearings are now equal to the combined clearings of the nine next largest cities, Vancouver, Ottawa, Hamilton, Quebec, Halifax, London, Calgary, St. John and Victoria.

Taxable property in Winnipeg is worth more than \$255,000,000, which is equivalent to the combined taxable property of the cities of Quebec, Ottawa, Hamilton and London; or equivalent to the total taxable property in all the cities in Canada between 15,000 and 50,000 population, excepting only Regina and Saskatoon; or equivalent to the total taxable property of all cities (49) in Canada between 5,000 and 15,000 population.

The City of Winnipeg contains more retail stores than some entire provinces in Canada, and is easily the third largest retailing centre in Canada, with close on 2,000 stores.

Winnipeg has the largest individual railway yard in the world, comprising 110 miles of trackage; the largest stock yards in the Dominion of Canada; the finest power facilities on the American continent; second largest grain business in the world.

## GROWTH

	1900	1919
Industry.....	\$8,606,248.00	\$90,000,000.00
	1909	1919
Postal Revenue.....	\$580,385.00	\$2,443,207.00
	1900	1919
Railway Mileage in Business Field	3,680 miles	17,000 miles
	1900	1919
Value of Schools.....	\$487,000.00	\$6,500,000.00
	1910-1911	1918-1919
Customs Duties Collected.....	\$6,491,183.12	\$10,479,339.70
	1902	1919
Inland Revenue.....	\$637,881.00	\$1,306,142.18

Write the **BOARD OF TRADE, Winnipeg, Canada**, for book-lets about Winnipeg. Special reports furnished free regarding any line of industry.